

In the Claims:

1. (Currently Amended) A method of forming an isolation structure, the method comprising:

providing a substrate having a trench formed therein, the trench having at least one rounded corner;

applying a first ~~nitrogen-containing nitride-containing~~ liner on a top surface of the substrate and the trench;

~~removing a portion of first nitride-containing liner such that a portion of the first liner remains within the trench and rounded corner; and~~

~~forming filling trench with~~ a trench-filling material over the first nitrogen-containing liner, the trench-filling material substantially filling the trench to form the isolation structure; and

removing a first portion of the first nitrogen-containing liner and the trench-filling material such that a second portion of the first nitrogen-containing liner and trench-filling material remains within the trench.

2. (Original) The method of claim 1, wherein the step of providing a substrate includes:

applying a mask layer to the substrate;

patterning the mask layer such that the patterned mask layer defines the trench;

etching the mask layer and the substrate to form the trench in the substrate; and

removing the mask layer.

3. (Currently Amended) The method of claim 2, wherein the mask layer comprises a silicon nitride mask layer.

4. (Currently Amended) The method of claim 2 ~~and 2~~, further comprising rounding the corners of the trench after etching the substrate.
5. (Currently Amended) The method of claim 4, wherein the rounding the corners of the trench comprises rounding the corners by annealing the substrate in a gaseous ambient.
6. (Currently Amended) The method of claim 4, wherein the rounding the corners of the trench comprises rounding the corners by annealing the substrate in a gaseous ambient ~~comprised of comprising a gas selected from the group consisting of hydrogen, nitrogen, helium, neon, argon, [[and]] xenon, [[and]] or a combination~~ combinations thereof.
7. (Currently Amended) The method of claim 4, wherein the rounding the corners of the trench comprises rounding the corners by annealing the substrate in a gaseous ambient, wherein the annealing is performed at a temperature of about 700 ~~[[and]] to~~ about 950 degrees Celsius.
8. (Currently Amended) The method of claim 4, wherein the rounding the corners of the trench comprises rounding the corners by annealing the substrate in a gaseous ambient, wherein the annealing is performed at a pressure of about 1 Torr to about 1000 Torr.
9. (Currently Amended) The method of claim 4, wherein the rounding the corners of the trench ~~comprising~~ comprises creating rounded corners having a radius of curvature of about 5 nm to about 50 nm.
10. (Currently Amended) The method of claim 1, wherein the first nitrogen-containing liner comprises Si_3N_4 .

11. (Currently Amended) The method of claim ~~[[1]]~~ 1, wherein the first nitrogen-containing liner comprises silicon oxynitride.
12. (Currently Amended) The method of claim 1, wherein the first nitrogen-containing liner has a nitrogen content of about 5 to about 60 percent.
13. (Currently Amended) The method of claim 1, wherein the first nitrogen-containing liner has a thickness in the range of about 5 to about 200 angstroms.
14. (Original) The method of claim 1, wherein the trench-filling material is a dielectric.
15. (Original) The method of claim 14, wherein the trench-filling material comprises silicon oxide.
16. (Currently Amended) The method of claim 1, ~~further comprising~~ wherein the removing is performed at least in part by planarizing the trench-filling material.
17. (Original) The method of claim 16, wherein the planarizing step is a chemical mechanical polishing step.
18. (Original) The method of claim 1, further comprising forming transistors in close proximity to the trench.
19. (Currently Amended) The method of claim 1, further comprising:
forming transistors on the substrate in close proximity to the trench;

depositing an inter-layer dielectric over the transistors; and
depositing a metal line on the [[said]] inter-layer dielectric.

20. (Currently Amended) The method of claim [[19]] 19, wherein the inter-layer dielectric comprises silicon oxide.

21. (Currently Amended) The method of claim [[19]] 19, wherein the [[said]] metal line comprises ~~a metal selected from the group consisting of aluminum, copper, and tungsten~~ tungsten, or a combination thereof.

22. (Currently Amended) A method of forming an isolation structure, the method comprising:

providing a substrate having a trench formed therein and a patterned mask thereon, the patterned mask overlies portions of the substrate adjacent to the trench;

etching a portion of the patterned mask to pull-back the patterned mask from an edge of the trench;

annealing the substrate in a gaseous ambient to form rounded corners on the trench;

forming a nitrogen-containing liner over the trench and the patterned mask;

filling the trench with a trench-filling material;

exposing the nitrogen-containing liner over the patterned mask;

removing a portion of the nitrogen-containing liner overlying the patterned mask; and

removing the patterned mask.

23. (Currently Amended) The method of claim ~~22 and 22~~, further comprising forming transistors on the substrate in close proximity to the trench.
24. (Currently Amended) The method of claim ~~22 and 22~~, further comprising:
forming transistors in a region of the substrate adjacent to the trench;
forming an inter-layer dielectric over the transistors; and
forming a metal line over the inter-layer dielectric.
25. (Currently Amended) The method of claim ~~[[24]] 24~~, wherein the inter-layer dielectric comprises silicon oxide.
26. (Currently Amended) The method of claim ~~[[24]] 24~~, wherein the metal line comprises ~~of a metal selected from the group consisting of aluminum, copper, and tungsten~~ tungsten, or a combination thereof.
27. (Currently Amended) The method of claim 22, wherein the patterned mask comprises ~~[[of]]~~ a silicon nitride layer overlying a silicon dioxide layer.
28. (Currently Amended) The method of ~~claim 22~~ claim 22, wherein the rounded corners have a radius of curvature of about 5 to about 50 nm.
29. (Currently Amended) The method of ~~claim 22~~ claim 22, wherein the annealing step is performed at a temperature of about 700 to about 950 degrees Celsius.

30. (Currently Amended) The method of claim 22, wherein the gaseous ambient comprises [[of]] hydrogen, nitrogen, helium, neon, argon, [[or]] xenon, or ~~any combinations~~ a combination thereof.
31. (Currently Amended) The method of claim 22, wherein the annealing is performed at a pressure of about 1 to 1000 Torr.
32. (Currently Amended) The method of claim 22, wherein the nitrogen-containing liner is ~~comprised of~~ comprises silicon nitride or silicon oxynitride.
33. (Currently Amended) The method of claim 22, wherein the nitrogen-containing liner has a nitrogen content of about 5 to 60 percent.
34. (Currently Amended) The method of claim 22, wherein the nitrogen-containing liner has a thickness of about 5 to 200 angstroms.
35. (Original) The method of claim 22, wherein the trench-filling material is a dielectric.
36. (Original) The method of claim 22, wherein the trench-filling material comprises silicon oxide.
37. (Original) The method of claim 22, further comprising planarizing to remove a portion of the trench-filling material.

38. (Original) The method of claim 22, further comprising planarizing to remove a portion of the trench-filling material, wherein the planarizing is performed by chemical mechanical polishing.
39. (Currently Amended) A method of forming an isolation structure, the method comprising:
providing a semiconductor substrate having a top surface and having a trench formed therein, the trench having rounded corners in a top portion and having rounded corners in a bottom portion;
forming a nitrogen-containing liner over the trench and the top surface;
filling the trench with a trench-filling material;
planarizing the trench-filling material such that the nitrogen-containing liner remains; and
removing the nitrogen-containing liner overlying the top surface.
40. (Currently Amended) The method of claim ~~39~~ and 39, further comprising forming transistors in a region of the semiconductor substrate adjacent to the trench.
41. (Currently Amended) The method of claim ~~40~~ and 40, further comprising:
forming an inter-layer dielectric over the transistors; and
forming a metal line on the inter-layer dielectric.
42. (Currently Amended) The method of ~~claim 41~~ claim 41, wherein the ~~[[said]]~~ inter-layer dielectric comprises of silicon oxide.

43. (Currently Amended) The method of ~~claim 41~~ claim 41, wherein the ~~[[said]]~~ metal line comprises ~~of a metal selected from a group comprising of aluminum, copper, and tungsten~~ tungsten, or a combination thereof.

44. (Original) The method of claim 39, wherein the rounded corners have a radius of curvature in the range of about 5 to about 50 nm.

45. (Currently Amended) The method of claim 39, wherein the providing the semiconductor substrate includes:

forming a patterned mask over the semiconductor substrate;

forming a trench in a portion of the semiconductor substrate not covered by the patterned mask;

removing the patterned mask; and

annealing the semiconductor substrate in a gaseous ambient to form the rounded corners.

46. (Currently Amended) The method of ~~claim 45~~ claim 45, wherein the annealing the semiconductor substrate is performed at a temperature in the range of about 700 to about 950 degrees Celsius.

47. (Currently Amended) The method of ~~claim 45~~ claim 45, wherein the gaseous ambient comprises hydrogen, nitrogen, helium, neon, argon, ~~[[or]]~~ xenon, or ~~any combinations a~~ combination thereof.

48. (Currently Amended) The method of ~~claim 45~~ claim 45, wherein the annealing the semiconductor substrate is performed at a pressure in the range of about 1 Torr to about 1000 Torr.
49. (Currently Amended) The method of claim 39 ~~and 39~~, further comprising forming a silicon dioxide liner prior to forming the nitrogen-containing liner.
50. (Currently Amended) The method of claim 39, wherein the nitrogen-containing liner comprises [[of]] silicon nitride or silicon oxynitride.
51. (Original) The method of claim 39, wherein the nitrogen-containing liner has a nitrogen content of about 5 to about 60 percent.
52. (Original) The method of claim 39, wherein the nitrogen-containing liner has a thickness in the range of about 5 to about 200 angstroms.
53. (Original) The method of claim 39, wherein the trench-filling material is a dielectric.
54. (Original) The method of claim 53, wherein the trench-filling material comprises silicon oxide.
55. (Currently Amended) The method of claim 39, wherein the planarizing the trench-filling material is performed by a chemical mechanical polishing process.
56. (Currently Amended) The method of claim [[55]] 55, wherein the chemical mechanical polishing process employs a slurry comprising [[of]] cerium oxide.

57. - 77. Cancelled.